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Forest Pest Management
Pacific Northwest Region

FOREST PEST EVALUATION

OF THE UMPIRE THIN

AND WHITLO PLANNING AREAS

BUTTE FALLS RANGER DISTRICT

ROGUE RIVER NATIONAL FOREST

OREGON

FOREST PEST EVALUATION OF THE UMPIRE THIN AND WHITLO PLANNING AREAS, BUTTE FALLS RANGER DISTRICT ROGUE RIVER NATIONAL FOREST, OREGON

BY

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SUMMARY

Two areas were surveyed on the Butte Falls Ranger District for pest-caused losses. About 17 percent of the 600-acre Umpire Thin area was found to be affected by laminated root rot, and at least 33 percent of the 420-acre Whitlo area has Armillaria root rot. Several management alternatives were discussed and analyzed economically. In the Umpire Thin area, clearcutting and planting pine rather than thinning infected areas was recommended, based on a comparison of present net values. In the Whitlo Area, clearcutting infected areas followed by stump treatment and planting of Douglas-fir was economically a better option than continuing with several rotations of white fir. Clearcutting and planting pine also appeared to be a viable option, since pine appeared to be less susceptible to root disease than white fir or Douglas-fir.

INTRODUCTION

Root diseases are particularly destructive in Pacific Northwest forests because of the many ways in which they impact forest productivity. Besides causing tree mortality and growth loss, root diseases can convert productive land to permanent brush fields and disrupt normal stand management activites such as thinning. In May 1984, a Forest Pest Management crew, at the request of the District, surveyed two areas (Figures 1 and 2) experiencing these kinds of losses. The following is a report describing the surveys, data analysis, and selection of management alternatives to reduce disease impact.

METHODS

Both areas were surveyed using a line-intercept method to estimate the percentage of area visibly affected by root disease. Parallel transects at

10-chain intervals were followed across each area with a compass. Root disease centers were mapped by measuring with a hip-chain the distance from the edge of the stand to the beginning and ending of a disease center along each transect. All root disease centers within two chains of the transect also were mapped by recording approximate diameter, distance from transect, and distance from stand boundaries. The lengths of transects falling within root disease centers divided by total transect lengths approximates the percentage of area affected by root disease. Presence of other pests in each area also was recorded.

Root diseases were detected following partial excavation and dissection of roots and root collars. Only dead or highly symptomatic (thin crowns, dead tops, basal resinosis) trees were examined. No attempt was made to detect root diseases in living trees without above-ground symptoms. Laminated root rot, caused by Phellinus weirii, was identified by the presence of ectotrophic mycelium on excavated roots and laminated decay with setal hyphae in stumps or in roots of windthrown trees. Armillaria root rot, caused by Armillaria mellea, was detected by the presence of mycelial fans beneath the bark of the root collar or by yellow, stringy, decayed wood with rhizomorphs.

RESULTS

Umpire Thin Area

The stand in the Umpire Thin area has an average age of 61 years and is composed primarily of Douglas-fir (Pseudotsuga menziesii) with some white fir (Abies concolor) and ponderosa pine (Pinus ponderosa) as determined from District stand exams and our survey. Other species observed in the stand were sugar pine (P. lambertiana), incense cedar (Libocedrus decurrens) and Pacific madrone (Arbutus menziesii). Site index at 50 years for Douglas-fir is 110.

Approximately 17 percent of the 600-acre area is estimated to be infected by P. weirii as determined by the line-intercept survey method. All of the infection occurs in the western portion of the stand (Fig. 3). In general, infected areas contain standing dead trees, windthrown trees, chlorotic trees, and apparently healthy trees. Many of the healthy-appearing trees probably are infected also, but do not show above-ground symptoms. We estimate that current volume yields from infected areas are about 75 percent of normal due primarily to laminated root rot. The most heavily infected areas contain no pine.

Only Douglas-fir and white fir were affected by laminated root rot. Ponderosa pine, sugar pine, and incense cedar are resistant to the disease. These species will sometimes become infected but rarely will die. Madrone and other hardwoods are immune.

Armillaria root rot and associated bark beetles were observed affecting isolated, weakened trees. Two small disease centers were observed in ponderosa pine. Damage caused by this disease is often seen in overstocked stands.Thinning should reduce competition and further mortality caused by Armillaria root rot and bark beetles.

Douglas-fir dwarf mistletoe (Arceuthobium douglassii) was observed at light levels throughout the stand. Moderately and severely infected trees should be discriminated against when thinning.

MANAGEMENT ALTERNATIVES

The following management alternatives and their effects on pest-caused losses are presented for the Umpire Thin area:

1. Thin entire stand/grow Douglas-fir - Damage as growth loss and mortality caused by dwarf mistletoe, Armillaria root rot, and bark beetles will be reduced through thinning. Within areas affected by laminated root rot, some wood that normally would be lost to mortality and deterioration can be captured. However, losses due to laminated root rot probably will offset any gains accomplished by thinning. An estimated 50 percent of the yield that would be obtained in a healthy stand will be lost to root rot if infected areas are thinned. Also, infection will continue to expand into healthy areas. It is extremely difficult to select uninfected residual trees based on above-ground symptoms. Apparently healthy but infected trees will either die standing or, more commonly, windthrow because of stand opening and reduced root systems due to root decay. If Douglas-fir or white fir is planted or regenerated naturally in infected areas, disease losses will be greater than in the previous rotation.

2. Thin entire stand/grow ponderosa pine - Damage in the current stand will be the same as in Alternative #1. However, if ponderosa pine, rather than Douglas-fir, is planted in infected areas after final harvest then root disease losses will be reduced and yield losses negligible in the next rotation.

3. Thin only healthy areas/grow pine - Damage caused by dwarf mistletoe, Armillaria root rot, and bark beetles will be reduced if the healthy portion of the stand is thinned. Laminated root rot will expand into healthy areas, but losses due to root rot will not be as great as they would be if infected areas were thinned. Planting ponderosa pine in infected areas will significantly reduce yield losses due to laminated root rot.

4. Clearcut infected areas/grow pine - If healthy areas are thinned now and clearcut units are arranged to include infected areas, damage caused by all pests will be reduced and future losses, especially caused by laminated root rot, will be minimized. Infected areas should be planted with any species besides Douglas-fir or white fir. All fir should be discriminated against through roguing and thinning as the stand matures.

An economic analysis was performed on the above alternatives. Douglas-fir was planted in all areas after final harvest (20 years after thinning) and grown for one rotation (80 years) in Alternative #1. Ponderosa pine was planted in infected areas instead of Douglas-fir after a normal rotation for Alternatives #2 and #3, and after a short rotation for Alternative #4.

The present net value (PNV) of each alternative was calculated at a 4 percent discount rate and a 1 percent annual stumpage price increase. For the analysis, the following volume yields were used for both the current (stand exam) and future (yield tables) stands:

	Board Feet Per Acre				
	Douglas-fir - Age 61		Douglas-fir	Ponderosa Pine	
	Residual	Excess (Thin)	Age 80	Age 80	100
Healthy Portion	23,781	6,813	54,303	52,425	60,075
Infected Portion[a]	21,586[b]	5,109[b]	27,152[c]	52,425	60,075

[a] Infected portion is 17 percent at 61 years and 20 percent at 80 years
[b] Predicted yield is 75 percent of normal
[c] Predicted yield is 50 percent of normal

Stumpage prices of $256 (final harvest) and $137 (thinned material) were used for Douglas-fir and $172 for ponderosa pine[1]. Harvest income for the entire area was a weighted average of the products of gross yield and stumpage from healthy and infected protions. For example, havest income for the entire area at an 80 year rotation is $12,512/acre = (27,152 x .20 x $.256) + (54,303 x .80 x $.256). After a rotation of pine on the infected portion, harvest income for the entire stand would be $12,925/acre = (52,425 x .20 x $.172) + (54,303 x .80 x $.256). The following time lines were used for each management alternative:

1. All Thin/Grow Douglas-fir

Year	0	20	21	100
	Com. Thin	Final Harvest		Final Harvest
Benefits/Acre	$893	$12,512		$11,817
Costs/Acre			$255 Site Prep.	

[1] From stumpage prices currently used by Rogue River NF planning process.

2. All Thin/Grow Pine

Year	0	20	21	100
	Com. Thin	Final Harvest		Final Harvest
Benefits/Acre	$893	$12,512		$12,925
Costs/Acre			$255 Site Prep.	

3. Leave Infected/Thin Healthy/Grow Pine

Year	0	20	21	100
	Com. Thin	Final Harvest		Final Harvest
Benefits/Acre	$774	$13,207		$12,925
Costs/Acre			$255 Site Prep.	

4. Clearcut Infected/Thin Healthy/Grow Pine

Year	0	1	20	21	100
	Final Harvest (17% of area) Com. Thin (83% of area)		Final Harvest (83% of area)		Final Harvest
Benefits/Acre	$1,714		$11,539		$13,295
Costs/Acre	$43 Site Prep. (17% of area)		$217 Site Prep. (83% of area)		

Treatment	PNV (4 percent) Dollars/Acre after 100 years	PNV Difference
1. All Thin/Grow Douglas-fir	8,377	0
2. All Thin/Grow Pine	8,436	59
3. Thin Healthy/Grow Pine	8,705	328
4. Clearcut Infected/Grow Pine	8,710	333

RECOMMENDATIONS

Based on the economic analysis, we recommend that either Alternative #3 or #4 be applied to the Umpire Thin area. Alternative #3 becomes more desirable as the early regeneration costs in Alternative #4 rise. However, even at double the normal regeneration costs, clearcutting infected areas now is better than thinning infected stands now and harvesting in 20 years. This is based mainly on the estimated severe losses that will occur in infected areas if they are thinned now and harvested in 20 years.

RESULTS

Whitlo Area

The stand in the Whitlo Planning area is composed almost entirely of uneven-aged white fir. Small amounts of Douglas-fir, ponderosa pine, lodgepole pine (P. contorta), and white pine (P. monticola) also can be found. Site index at 50 years for Douglas-fir is 110.

Approximately 33 percent of the 420-acre area is estimated to be affected by Armillaria root rot as determined by the line-intercept method. A practical treatment area would approach nearly 50 percent since all of the damage appears in the southern half of the area (Fig. 4). Much of the northern half has received shelterwood treatments. There was evidence of some damage in lightly harvested and seed tree/shelterwood areas.

In general, infected areas appear as a mosaic of discrete root disease centers composed of snags and stubs and healthier appearing areas composed of live trees with scattered dead and dying trees. In one area, infection is so severe that nearly all conifers have been replaced by shrubs - the Whitlo Brushfield. Some of this area has received mechanical treatment to eliminate the brush and has been replanted with ponderosa pine and incense cedar. We estimate that current volume yields from infected areas are about 50 percent of normal due primarily to Armillaria root rot.

Only white fir and Douglas-fir were found to have Armillaria root rot. What little pine there was in the stand appeared to be healthy. Ponderosa pine has been severely damaged by Armillaria in some stands on the Forest (Tkacz and others 1981)[1]. In other stands, however, ponderosa pine appeared to be more resistant to Armillaria than white fir (Filip and others 1980)[2].

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[1] Tkacz, B. M., J. S. Worrell, and G. M. Filip 1981. Root Disease Survey of the Mistletoe and Ski Overstory Sale Areas, Prospect Ranger District, Rogue River National Forest, Oregon, FPM Office Report, 18p.

[2] Filip, G. M., J. S. Worrell, and B. M. Tkacz 1980. Loss Due to Root Diseases in the Bybee Creek Area, Prospect Ranger District, Rogue River National Forest, Oregon, FPM Office Report, 13p.

Another disease that commonly was found in white fir was heartrot caused by the Indian paint fungus, Echinodontium tinctorium. This problem is usually associated with old-growth stands that have a history of early suppression and severe wounding. Heartrot is not a problem if stands are grown on short rotations (150 years or less) with minimal wounding (20 percent of crop trees) (Filip and others 1983)[1].

Insect problems were noted primarily in white fir where fir engravers (Scolytus ventralis) were constantly associated with root diseased trees and in lodgepole pine where mountain pine beetle (Dendroctonus ponderosae) had killed isolated trees.

MANAGEMENT ALTERNATIVES

The following management alternatives and their effects on pest caused losses are presented for the Whitlo Area:

1. Clearcut/Seedtree-Shelterwood Cut/Grow White Fir - Decay caused by the Indian paint fungus will be minimized if the current stands are regenerated either by clearcutting or through a seed tree/shelterwood system and future stands are grown on rotations of 150 years or less. However, damage caused by Armillaria root rot and associated fir engravers will continue to expand into healthy areas to where 100 percent of the area could be infected after two rotations of white fir (200 years). Yield losses within expanding infected areas are estimated to be 50 percent.

2. Clearcut/Grow Pine - This alternative differs from #1 in that a species that appears more resistant to Armillaria, at least in the Whitlo area, is planted instead of regenerating white fir. By planting ponderosa pine, we estimate a 25 percent yield loss at the end of a 100 year rotation versus a 50 percent yield loss for white fir. Disease expansion into healthy areas will also be slower--5 percent per 100 year rotation--than if white fir is regenerated. If Douglas-fir is planted in infested sites, damage probably would be similar to white fir, since infected and killed Douglas-fir were found in the area.

3. Clearcut/Stump Treat/Grow Douglas-fir - This alternative differs from #1 and #2 in that following harvest of the current stand, all infected stumps are treated either by excavation or fumigation to remove potential inoculum sources. The area can then be planted with Douglas-fir, the most valuable species, with what we estimate to be a 90 percent of normal yield at rotation age (100 years). The topography in the Whitlo area is fairly level, so stump excavation could be done. Anticipated problems associated with stump removal are missed inoculum and soil damage through soil mixing and compaction, hence a 10 percent estimated yield loss. This loss may increase for subsequent rotations, especially if significant infection and mortality occur after treatment.

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[1] Filip, G. M., P. E. Aho, and M. R. Wiitala 1983. Indian paint fungus; amethod for recognizing and reducing hazard in advanced grand and white fir regeneration in eastern Oregon and Washington. Forest Pest Management, Pacific Northwest Region, USDA Forest Service, Porland, OR, 18 p.

Stump fumigation is still experimental, but it would avoid the problems of soil damage.

Costs for either stump excavation or fumigation are estimated at about $600/acre including site preparation and planting. Both stump excavation and fumigation trials are planned for the adjacent Prospect Ranger District.

An economic analysis was performed on the above alternatives at a 4 percent discount rate and a 1 percent annual stumpage price increase. For the analysis, the following volume yields were used:

	Board-Feet Per Acre (Age 100)		
	White fir	Douglas-fir	Ponderosa Pine
Healthy Portion	108,918	72,210	60,075
Infected Portion[a]	54,459[b]	------	45,056[c]

[a] Infected portion increases by 25 percent per 100 years for white fir stands and by 5 percent per 100 years for ponderosa pine stands
[b] Predicted yield is 50 percent of normal
[c] Predicted yield is 75 percent of normal

Stumpage prices of $161, $256, and $172 per thousand board feet were used for white fir, Douglas-fir, and ponderosa pine, respectively. Harvest income for the entire area was a weighted average of the products of gross yield and stumpage from healthy and infected protions. The following time lines were used for each management alternative:

1. Clearcut/Seed Tree-Shelterwood Cut/Grow White Fir

Year	Harvest 0	1	Harvest 100	101	Harvest 200	201	Harvest 300
Benefits/Acre	$13,152		$10,960		$8,768		$4,384
Costs/Acre		$300 Site Prep.		$300 Site Prep.		$300 Site Prep.	

2. Clearcut/Grow Pine

Year	Harvest 0	1	Harvest 100	101	Harvest 200	201	Harvest 300
Benefits/Acre	$13,152		$12,154		$11,664		$11,175
Costs/Acre		$325 Site Prep.		$325 Site Prep.		$325 Site Prep.	

3. Clearcut/Stump Treat/Grow Douglas-fir

Year	Harvest 0	1	Harvest 100	101	Harvest 200	201	Harvest 300
Benefits/Acre	$13,152		$17,087		$17,087		$17,087
Costs/Acre		$465 Site Prep.		$325 Site Prep.		$325 Site Prep.	

Harvest incomes are displayed at only one point in time per rotation where if seed tree/shelterwood systems were used, harvest incomes would be at two times per rotation.

Treatment	PNV (4 percent)	PNV Difference
	Dollars/Acre after 300 years	
1. Clearcut/Seed Tree-Shelterwood Cut/Grow White Fir	$13,459	0
2. Clearcut/Grow Ponderosa Pine	$13,507	48
3. Clearcut/Stump Treat/ Grow Douglas-fir	$13,647	188

RECOMMENDATIONS

Based on the economic analysis, we recommended that either Alternative #2 or #3 be applied to the Whitlo area with #3 being preferred. A combination of both alternatives probably would be best where some units could be planted to pine and other units could have stumps treated, either excavated or fumigated, and planted to Douglas-fir. Since there are some uncertainties with either alternative, small trials of each would provide the opportunity for evaluation. FPM pathologists are available to assist the District in planning and implementing stump treatment alternatives and may be able to provide additional funding for such activities.

The information and recommendations presented in this report have been specifically formulated for the Umpire Thin and Whitlo areas. Although some of this information may be applied to other areas in Oregon and Washington experiencing similar pest problems, these areas may be sufficiently different from the area we surveyed to warrant a separate biological evaluation to formulate management alterntives specific to that area. FPM pathologists and entomologists encourage and are available to perform such evaluations at the request of land managers.

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Ellen Michaels, Biological Technician — Date

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James S. Hadfield, Supervisory Plant Pathologist — Date

Approved by: Paul E. Buffam — 8/16/84
Paul E. Buffam, Director, FPM — Date

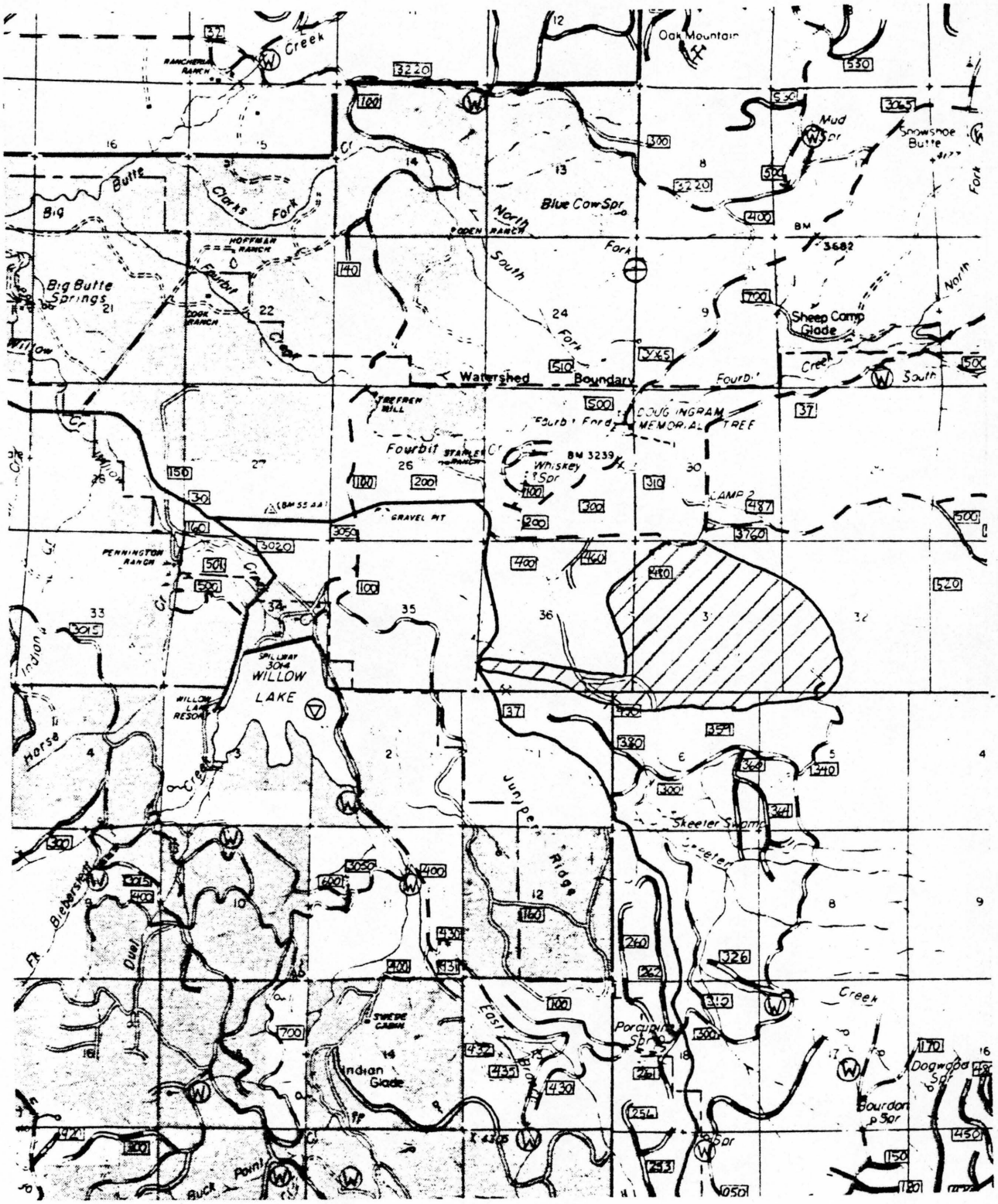

Figure 1.--Map showing location (crosshatching) of the Umpire Thin Area on the Butte Falls Ranger District

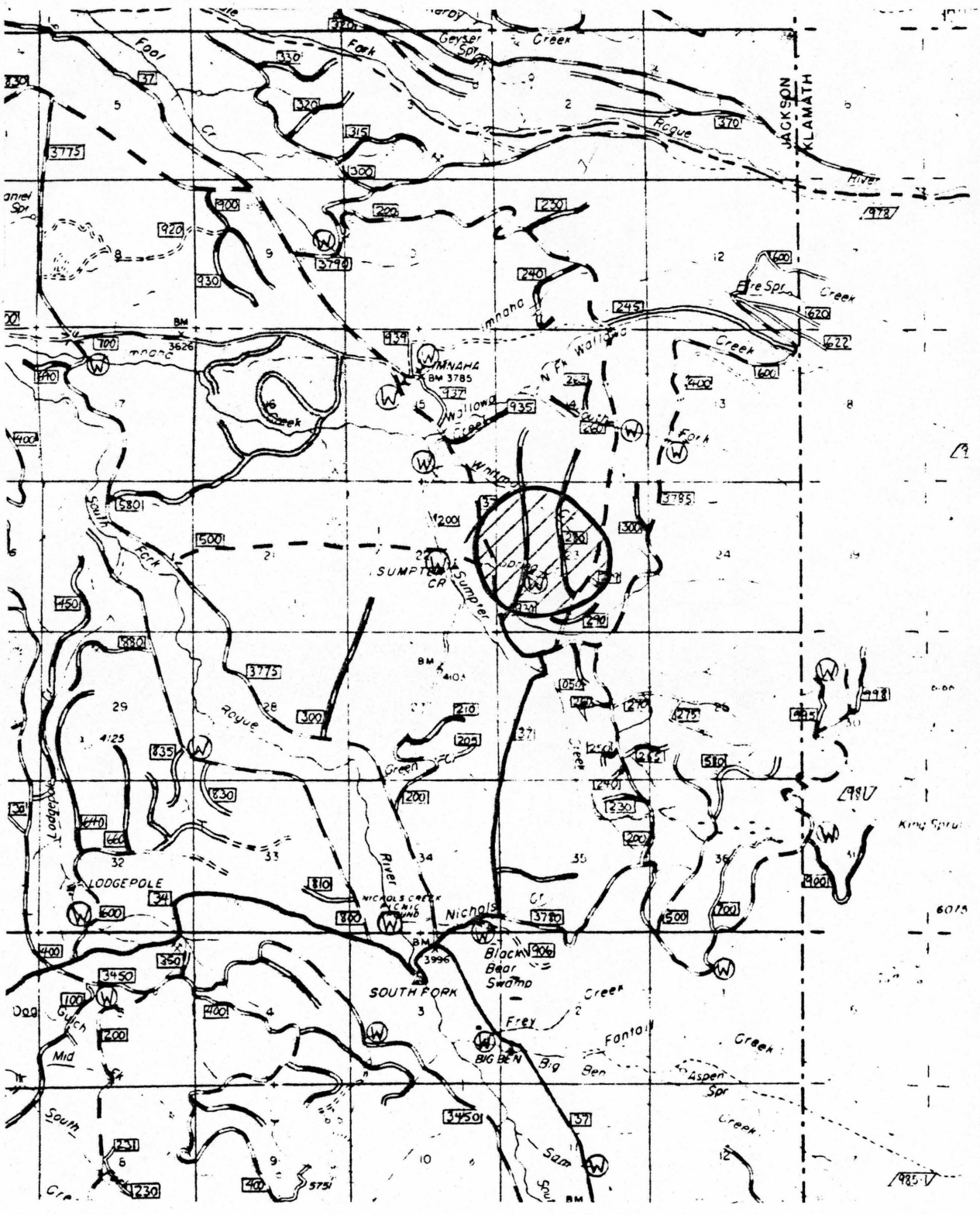

Figure 2.--Map showing location (crosshatching) of the Whitlo Area on the Butte Falls Ranger District.

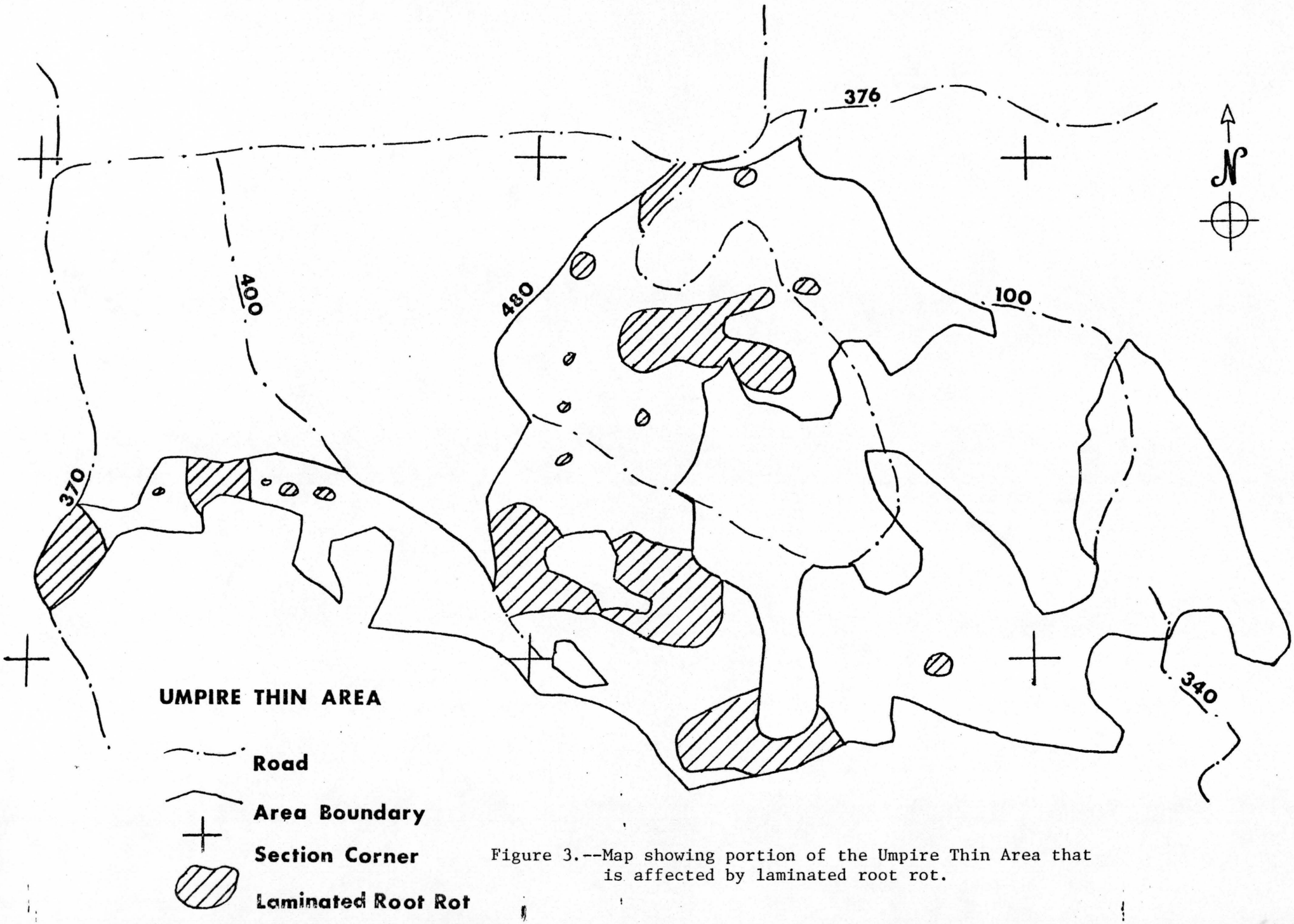

Figure 3.--Map showing portion of the Umpire Thin Area that is affected by laminated root rot.

HITLO ROOT ROT

LEGEND

SCALE=1320(FT/IN)

UNIT BOUNDARY

ROAD MAINTENANCE

ROAD RECONSTRUCTION

ROAD CONSTRUCTION

TEMPORARY ROAD

T 33 S, R 4 E

Approximate acreage: 420

ARMILLARIA ROOT ROT

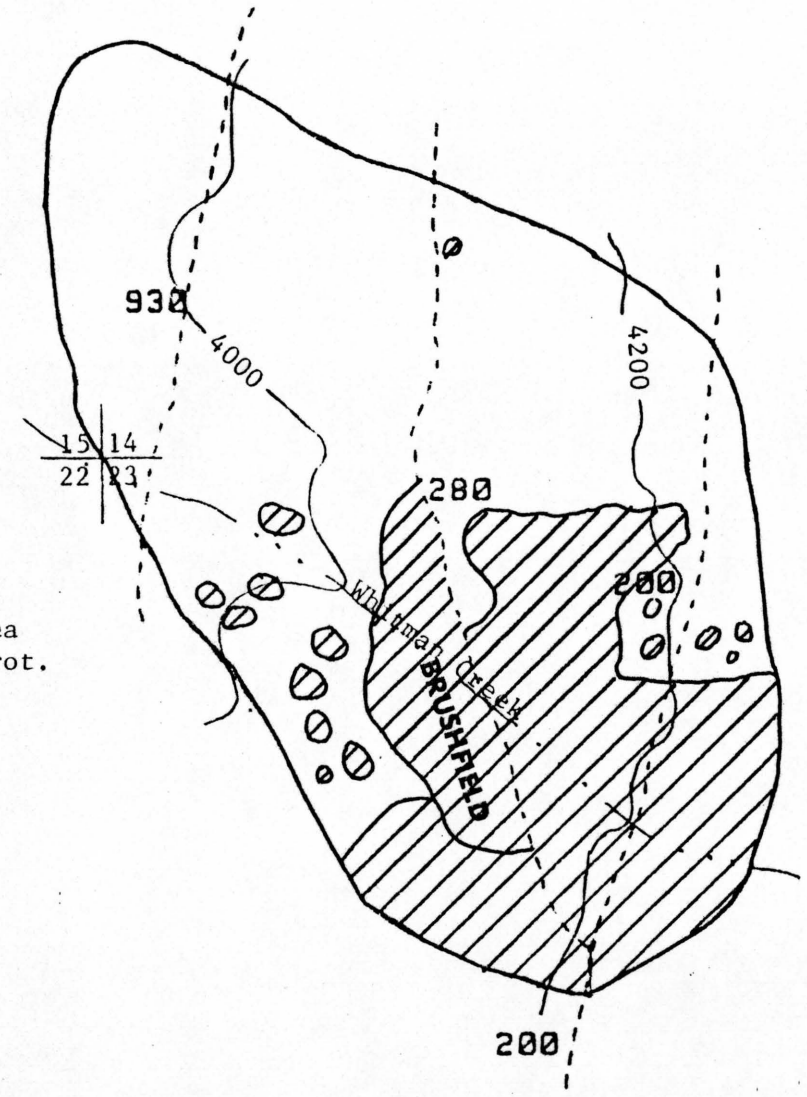

Figure 4.--Map showing portion of the Whitlo Area that is affected by armillaria root rot.